Merchant & Gould P.C.
Inventor: Gill, et al.
Docket No.: 7500.360US01
Title IMPROVEMENTS IN AND RELATING TO ANALYSIS OF
DNA SAMPLES
Attorney Name John J Gresens
Phone No ℡12 371 5265
Sheet 1 of 12

Fig. 1

SET A

SET B

SET C

SET D

Fig. 2

SET A

SET B

SET C

Merchant & Gould P C
Inventor: Gill, et al.
Docket No.: 7500.360US01
Title   IMPROVEMENTS IN AND RELATING TO ANALYSIS OF DNA SAMPLES
Attorney Name   John J Gresens
Phone No   '612 371 5265
Sheet 2 of 12

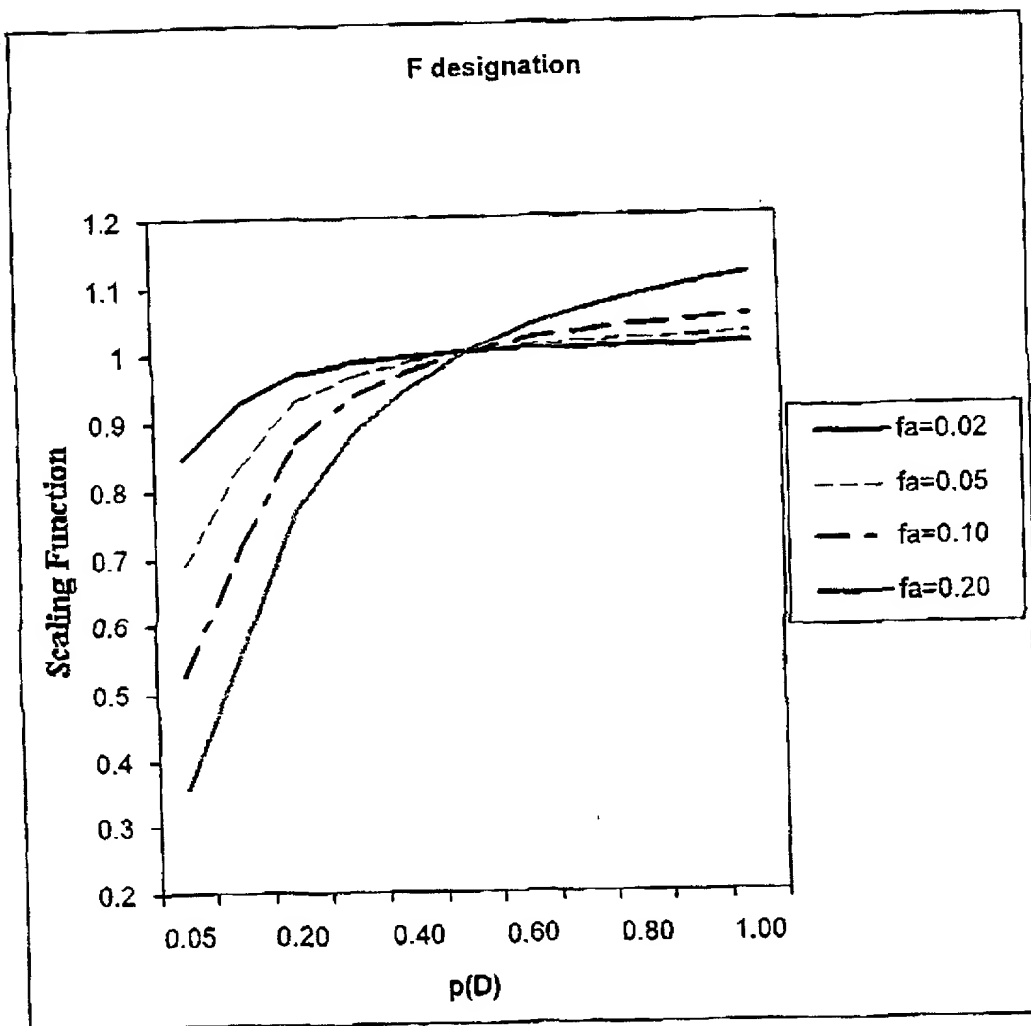| M_i	$P(M_i)$	$R_1 (12)$	$R_2 (16)$	$R_3 (12,16)$	Products
12 12	f_{12}^2	$p(D)p(C)$	$p(D)p(C)f_{16}$	$p(D)p(C)f_{16}$	$p(D)^2 p(C)p(D)p(C)^2 f_{12} f_{16}^2$
12 16	$2f_{12}f_{16}$	$p(D)p(C)p(D)$	$p(D)p(C)p(D)$	$p(D)^2 p(C)$	$2p(D)^4 p(C)^3 p(D)^2 f_{12} f_{16}$
16 16	f_{16}^2	$p(D)p(C)f_{12}$	$p(D)p(C)$	$p(D)p(C)f_{12}$	$p(D)^2 p(C)p(D)p(C)^2 f_{12}^2 f_{16}$
					$Denominator = sum\ of\ above$

Table 1: Calculation of the components of the likelihood ratio for an example where 3 replicates show evidence of spurious bands and allele drop-out.

Fig. 3

Merchant & Co
Inventor: Gill, et al.
Docket No   7500 360US01
Title   IMPROVEMENTS IN AND RELATING TO ANALYSIS OF
DNA SAMPLES
Attorney Name   John J Gresens
Phone No* 612 371 5265
Sheet 3 of 12

M_j	$P(M_j)$	$R_1=abc$	$R_2=ac$	Products
ab	$2f_af_b$	$p(D)^2 p(C)f_c p(St)^2$	$p(D)p(D)p(C)f_c p(St)^2$	$2f_af_bf_c^2 p(D)^3 p(D)p(C)^2 p(St)^4$
ac	$2f_af_c$	$p(\overline{D})^2 p(\overline{St})(p(St)p(\overline{C}) + p(\overline{St})p(C)f_b)$	$p(D)^2 p(C)p(St)^2$	$2f_af_c p(\overline{D})^4 p(\overline{C})p(St)^3 [p(St)p(\overline{C}) + p(\overline{St})p(C)f_b]$
bc	$2f_bf_c$	$p(\overline{D})^2 p(C)f_a p(St)$	$p(D)p(D)p(C)f_a p(St)^2$	$2f_b^2 f_af_c p(D)^3 p(D)p(C)^2 p(St)^3$

Table 2: Derivation of equation 12. Note that $p(\overline{St})$ only appears once when $M_j=bc$ and $R_1=abc$ because b must be in part or wholly allelic.
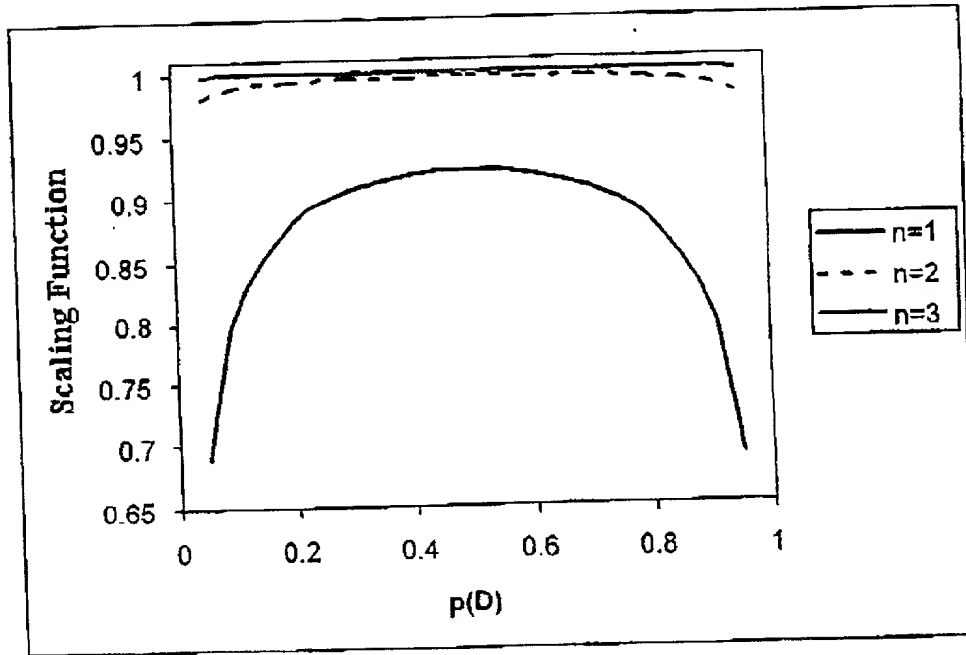
Fig. 4

Inventor: Gill, et al.
Docket No.: 7500.360US01
Title: IMPROVEMENTS IN AND RELATING TO ANALYSIS OF
DNA SAMPLES
Attorney Name John J Gresens
Phone No 612 371 5265
Sheet 4 of 12

F designation

Testing the robustness of the F designation. The F designation is conservative provided that the expression $\dfrac{1}{\left[1+\dfrac{1-2p(D)}{2p(D)}f_a\right]} \Box 1.0$ (from equation 7).
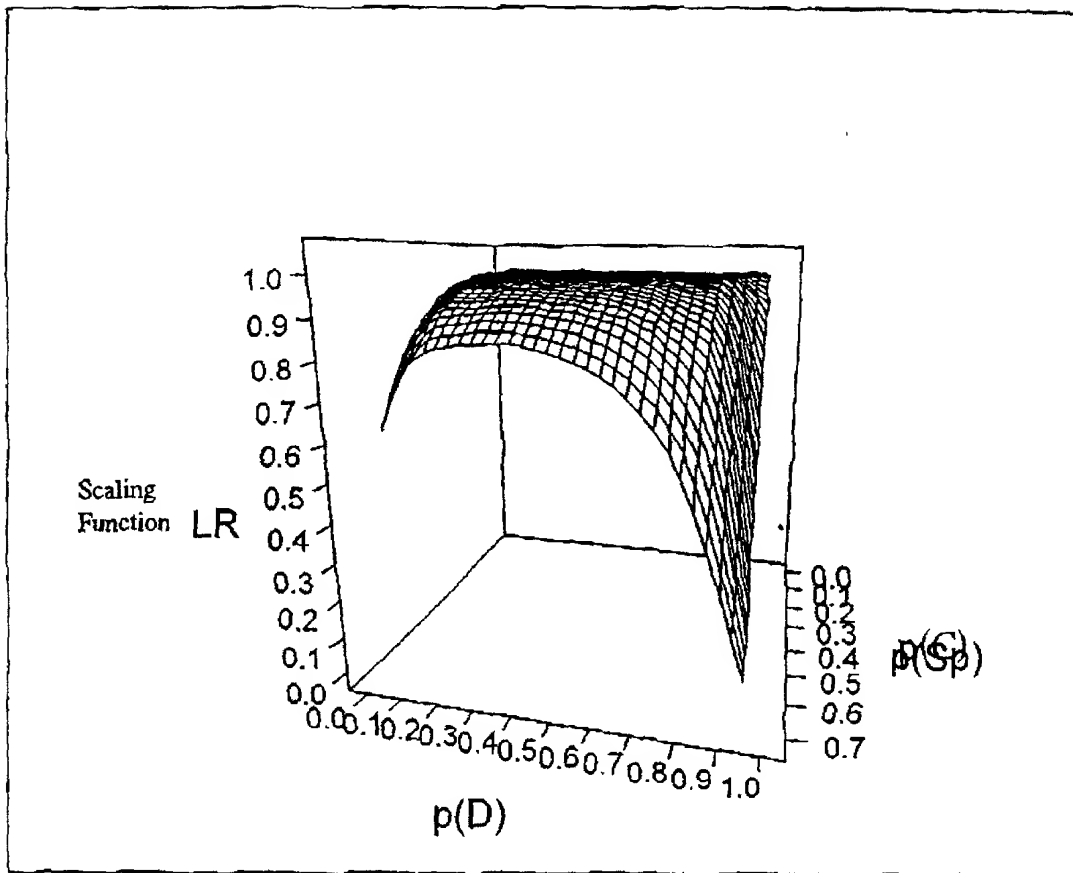
Allele frequencies (f_a) 0.02, 0.05, 0.10 and 0.20 are tested. Generally the F designation is conservative provided $p(D)>0.5$.

Fig. 5

Merchant & Gould PC
Inventor: Gill, et al.
Docket No.: 7500.360US01
Title IMPROVEMENTS IN AND RELATING TO ANALYSIS OF
DNA SAMPLES
Attorney Name John J Gresens
Phone No' 612 371 5265'
Sheet 5 of 12

Evaluation of $\dfrac{1}{\left[1+\dfrac{f_a f_h^{n-1} p(C)^n}{2p(D)[p(D)p(C)]^n}\right]}$ from equation 9 (called the scaling function). When n (the number of replicates where the genotype is ab) is greater than or equal to 2 and $R_1 = a$, then the $LR \square 1/2f_a f_b$. When $n=1$, $1/2f_a$ would be used which is always conservative. In fig 2a $p(C)=0.3$; $f_a=f_b=0.1$.

Fig. 6a

Inventor: Gill, et al.
Docket No.: 7500.360US01
Title IMPROVEMENTS IN AND RELATING TO ANALYSIS OF
DNA SAMPLES
Attorney Name John J Gresens
Phone No 612 371 5265
Sheet 6 of 12

The 3 dimensional model showing the relationships between *p(C)* and *p(D)* when f_a=0.1. The scaling function □1.0 for moderate and low values of *p(C)* and for all intermediate values of p(D).
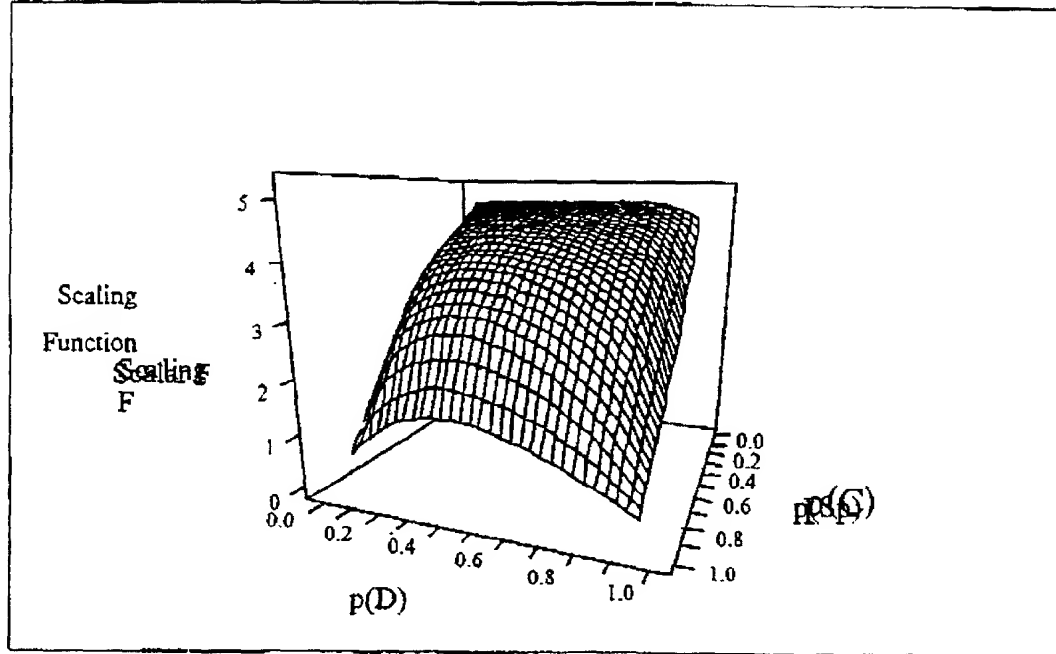
Fig. 6b
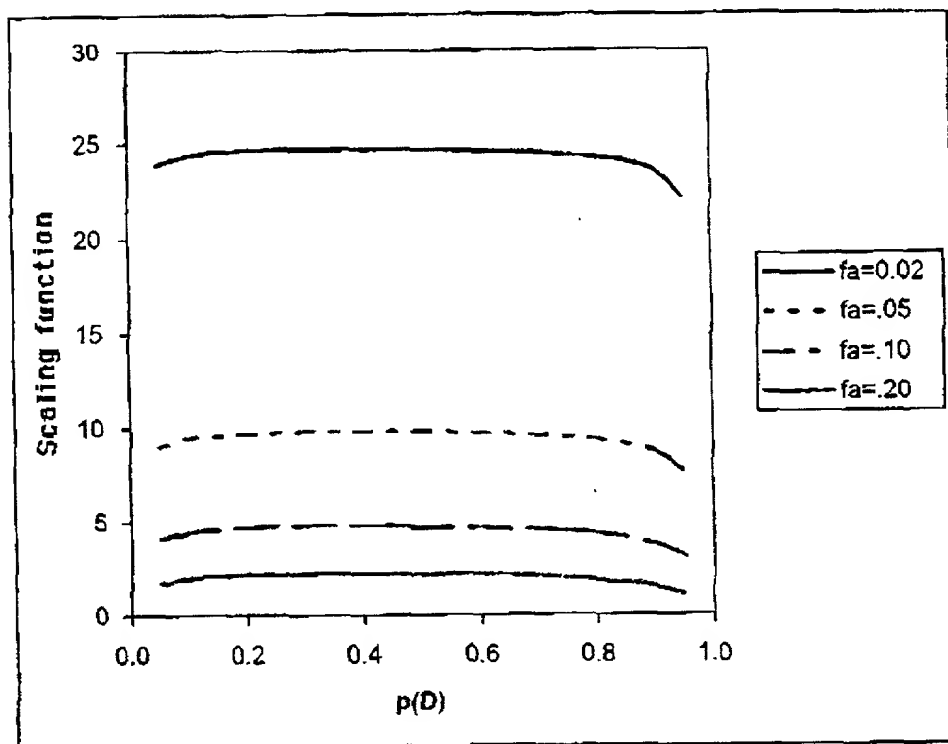
Provided that the scaling function

$$\frac{1}{f_a\left[2 + \dfrac{f_b p(D)p(C)}{p(\overline{D})p(\overline{C})} + \dfrac{f_b p(C)}{2p(D)p(D)p(\overline{C})}\right]} \geq 1.0$$

(from equation 10) then $1/2f_b$ is conservative. Allele frequencies are
$f_a=f_b=0.02, 0.05, 0.1, 0.2$ respectively and

Fig. 7a

Inventor: Gill, et al.
Docket No.: 7500.360US01
Title IMPROVEMENTS IN AND RELATING TO ANALYSIS OF
DNA SAMPLES
Attorney Name John J Gresens
Phone No •612 371 5265 ,
Sheet 8 of 12

$p(C)=0.3.$

3- dimensional graph to show the combined effect of $p(D)$ and $p(C)$ when $f_a=0.10$.
The critical point where the scaling function >1 is reached when $p(C)<0.9$ and $p(D)<0.9$.
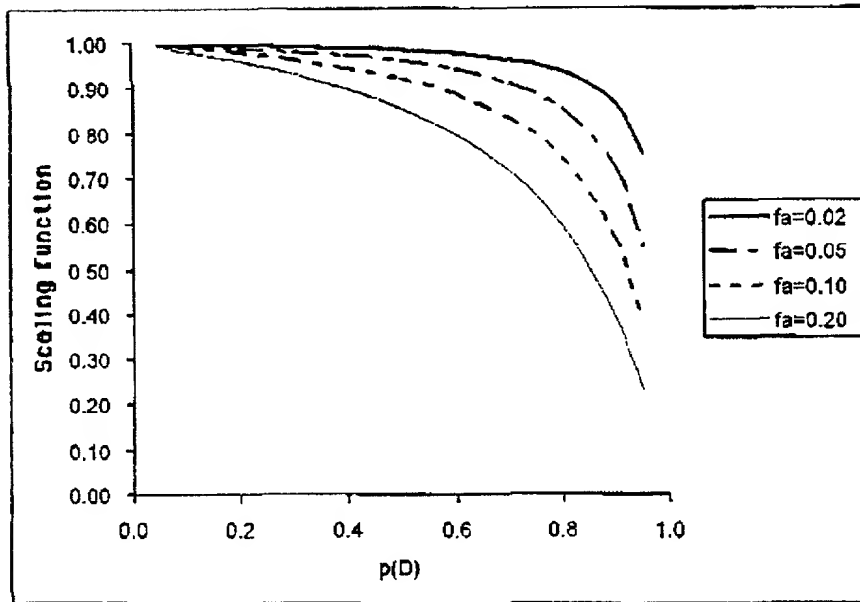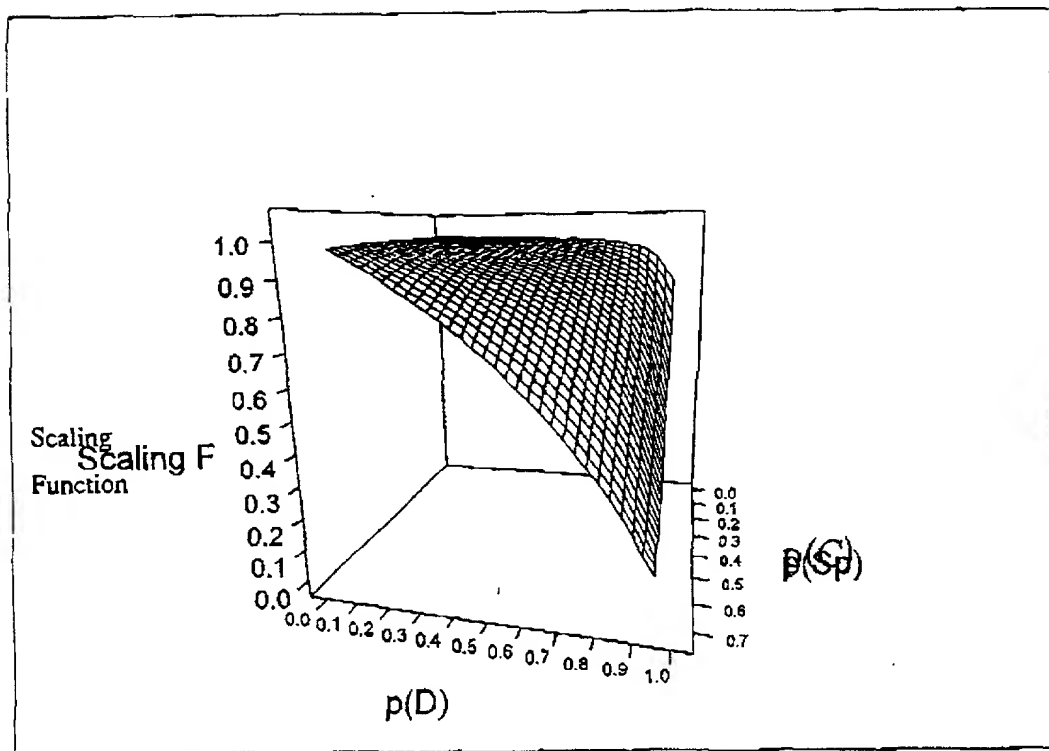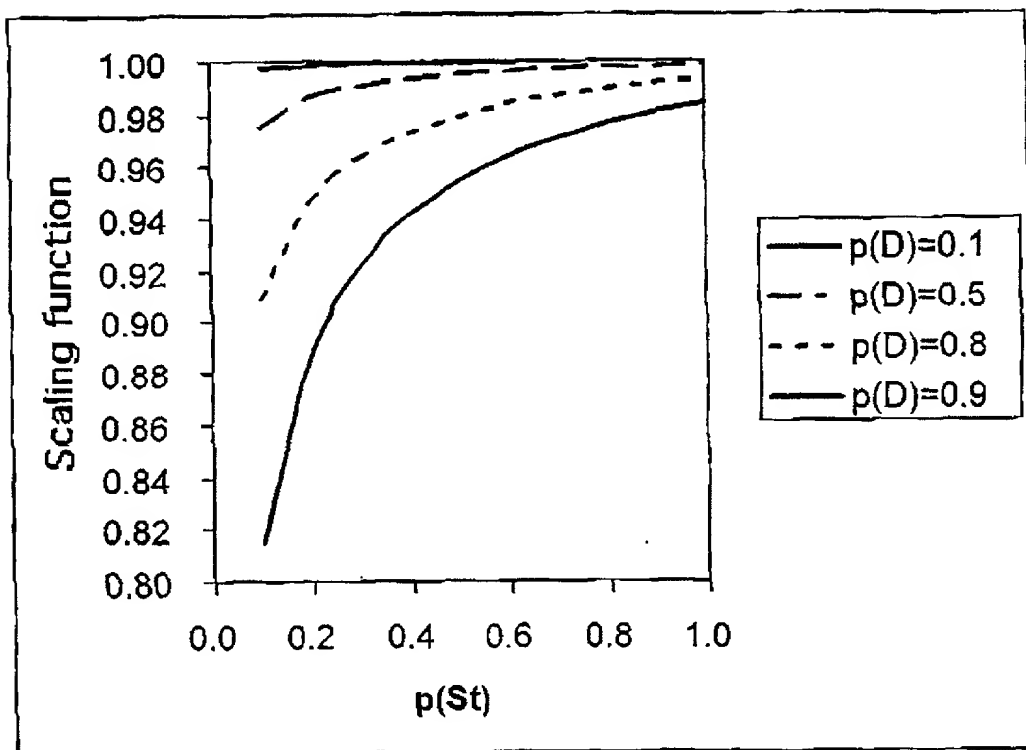
Fig. 7b

Inventor: Gill, et al.
Docket No.: 7500.360US01
Title: IMPROVEMENTS IN AND RELATING TO ANALYSIS OF
DNA SAMPLES
Attorney Name   John J Gresens
Phone No   612 371 5265   .
Sheet 9 of 12

Fig. 8a

Merchant & Gould P.C.
Inventor: Gill, et al.
Docket No.: 7500.360US01
Title: IMPROVEMENTS IN AND RELATING TO ANALYSIS OF
DNA SAMPLES
Attorney Name John J Gresens
Phone No 612 371 5265
Sheet 10 of 12

When f_d=.1, the LR□1 when $p(D)$<0.5 and $p(C)$<0.3.

Fig. 8b

Plots of scaling function

$$\frac{1}{\left[1+\dfrac{p(C)^2\,p(D)\,f_b\,(f_a+p(\overline{St})f_c)}{p(\overline{C})p(\overline{D})\left\{p(St)p(\overline{C})+p(\overline{St})p(C)f_b\right\}}\right]}$$

(equation 12) v. $p(St)$ for several levels of $p(D)$ ranging from $0.1 - 0.9$. $p(C)=0.3$ and $fa=fb=fc=0.1$.

Fig. 9

p(D)	Amelo	D19S433	D3S1358	D8S1179	HUMTHO1	HUMVWFA31/A	D2S1338	HUMFIBRA (FGA)	D16S539	D18S51	D2S1338	Mean
p(D Hₐ)	0.40	0.60	0.60	0.56	0.32	0.82		0.26	0.44	0.32	0.20	0.54
p(D Hd)					0.92		0.98	0.28	0.44	0.32	0.20	0.92
p(D Hus)					0.04		0.62	0.06	0.46	0.56	0.70	0.58

Table 3: Analysis of *p(D)* parameters derived from Table 1 of Gill et al [11].

Fig. 10